A Guide to Transitioning from the Grasshopper to the Grasshopper2 FireWire Camera

Technical Application Note TAN2011001
Revised May 24, 2012

1.1 Subject

Technical Application Note (TAN2011001): A Guide to Transitioning from the Grasshopper to the Grasshopper2 FireWire Camera

1.2 Applicable Product(s)

- GRAS (all models)
- GS2-FW

1.3 Application Note Description

The fully redesigned Grasshopper2 FireWire camera is the next generation version of the high performance Grasshopper. Housed in the same form factor as the Grasshopper, the Grasshopper2 offers several new features, including improved frame rates, optimized imaging performance and extended shutter Format_7 modes, enhanced opto-isolated GPIO, and conformance to version 1.32 of the Instrumentation & Industrial Digital Camera (IIDC) specification.

The purpose of this Technical Application Note is to:

1. Outline the primary similarities and differences between the two cameras; and
2. Offer suggestions and pointers to end users for migrating their custom applications from the *Grasshopper* to the *Grasshopper2*.

For customers upgrading from a Grasshopper *camera, Point Grey strongly encourages putting the* Grasshopper2 *through a full requalification process.*

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For users migrating from the Grasshopper *to the* Grasshopper2 *Gigabit Ethernet camera, see Knowledge Base Article 350.*

1.4 General Considerations

1.4.1 Other Reference Documentation

Other useful sources of information regarding specific features of the Applicable Product(s) include:

- Grasshopper Getting Started Manual
- Grasshopper2 Getting Started Manual (forthcoming)
- Grasshopper and Grasshopper2 GS2-FW Technical Reference Manuals

1.4.2 Testing Tools

To configure and test the information presented in this TAN:

1. **Connect the camera's GPIO pins to an oscilloscope or external trigger source.** By connecting the appropriate GPIO pins to an external trigger source or oscilloscope, you can observe the differences in general purpose input/output capability of the Applicable Product(s). Consult your camera's *Technical Reference* or *Getting Started* manual for:
    a. GPIO connector pin layouts; and
    b. GPIO electrical characteristics

2. **Download the FlyCapture SDK.** The SDK includes numerous example programs that demonstrate various camera features. Specific examples that relate to this TAN include *CustomImageEx*, *AsyncTriggerEx* and *SaveImageToFlashEx*.

3. **Access the camera's register space.** The easiest way to try this is using the FlyCap demo software included with the *FlyCapture SDK*. For register definitions and individual bit descriptions, please refer to the *Point Grey Digital Camera Register Reference* or your camera's *Technical Reference* manual.

1.5 Mechanics

The Grasshopper and Grasshopper2 share the same form factor and general mechanical properties.

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Description	Grasshopper	Grasshopper2
IR cut filter properties	The infrared cut-off filter used with color versions of the cameras is the same and has the same transmittance properties.	
GPIO connector	Hirose HR25 8 pin connector	
CCD sensor placement on PCB	The chip and lens holder mounting holes are centered relative to the four corner mounting holes.	
Overall dimensions	Industry standard 44mm x 29mm x 58mm (excluding lens holder and 1394/GPIO connector)	
Lens holder	C-mount	
Case description	Black zinc (casted) with black aluminum top and Point Grey logo	
Mass	104g (excluding including optics)	
Tripod mounting bracket	Secured by four (4) M2x2mm screws Meets ISO and ASA standards Included free of charge with every camera	
Mounting holes	Three (3) M3x2.5mm holes on the bottom face Four (4) M2x2mm holes on the bottom face (for mounting bracket) Two (2) M2 holes on the top face	
Removable glass / IR filter system	BW models: protective dust glass between sensor and optics COL models: IR filter between sensor and optics Glass / IR filter screwed into place to allow easy removal	
Development kit	Includes cable, 1394 interface card, software CD and Getting Started Manual.	Includes cable, 1394 interface card, software CD. Getting Started Manual available for download.

1.5.1 GPIO Properties

Pin	Grasshopper	Grasshopper2
GPIO0 (Pin 1)	Bi-directional input/output Default direction: input Default function: trigger Drive strength: 10 mA at 30 V	Opto-isolated input (+3.3 V to +30 V) Direction: input Default function: trigger in Input delay time: 4 µs

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Pin	Grasshopper	Grasshopper2
GPIO1 (Pin 2)	Bi-directional input/output Default direction: output Drive strength: 10 mA at 30 V	Opto-isolated open collector output (+3.3V to +30V) Direction: output Default function: strobe Drive strength: 25 mA at 30 V
GPIO2 (Pin 3)	Bi-directional input/output Default direction: output Drive strength: 10 mA at 30 V	Bi-directional input/output Default direction: output Drive strength: 25 mA at 30 V
GPIO3 (Pin 4)	Bi-directional input/output Default direction: input Drive strength: 10 mA at 30 V	Bi-directional input/output Default direction: input Drive strength: 25 mA at 30 V
GND (Pin 5)	Ground pin for all pins	Ground pin for bi-directional IO, Vext, +3.3 V
GND (Pin 6)	Ground pin for all pins	Ground pin for opto-isolated IO pins
V_{EXT} (Pin 7)	Power camera externally	
+3.3V (Pin 8)	Power external circuitry up to a total of 150 mA.	

1.5.2 Other Hardware and Electronics

Description	Grasshopper	Grasshopper2
CCD imaging sensors	640x480 Kodak KAI-0340 648x488 Sony ICX414 1384x1032 Sony ICX267 1384x1036 Sony ICX285 1624x1224 Sony ICX274 2448x2048 Sony ICX625	1384x1036 Sony ICX285
IEEE-1394 interface	9-pin IEEE-1394b (800Mb/s) Connector flush with case Secure jack screw connector	
Power consumption	Less than 2.5 W	
A/D converter	Analog Devices, 14-bit resolution	
Temperature Sensor	On-board; accessible via control and status registers (CSRs)	On-board; accessible via control and status registers (CSRs)
Voltage Sensor		

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Description	Grasshopper	Grasshopper2
Current Sensor	None	
LED Behavior	Same	

1.5.3 Firmware

This section does not address the significant number of firmware enhancements that have been added in the *Grasshopper2*, but focuses on functional differences between the two cameras that could affect integration of the *Grasshopper2* in existing *Grasshopper*-based applications. Users are encouraged to download the documents listed in Section 1.4.1: Other Reference Documentation for assistance with terms, camera specifications, and register definitions.

Many default startup (power-up) parameters, such as resolution, frame rate, gain, and shutter, have changed in the Grasshopper2. *The memory channels on the* Grasshopper2 *can be used for creating new default settings.*

Point Grey cannot predict if or how all of the following differences may affect user applications. This section provides recommendations on how to address some of the most obvious differences in functionality.

1.5.3.1 Format_7

Description	Grasshopper	Grasshopper2
Max Frame Rate at Max Resolution	15 FPS (ICX285)	30 FPS (ICX285)
Pixel Formats	Mono8, Mono16, Raw8, Raw16, YUV411, YUV422, YUV444, RGB8	Mono8, Mono12, Mono16, Raw8, Raw12, Raw16, YUV411, YUV422, YUV444, RGB8
Modes		
Mode_0	Region of interest only	Region of interest only; yields fastest frame rates

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Description	Grasshopper	Grasshopper2
Mode_1	2X vertical binning and 2X horizontal subsampling; values are aggregated and averaged; limited or no increase in intensity	2X vertical binning and 2X horizontal subsampling (monochrome models) or 2X vertical and 2x horizontal subsampling (color models); values are aggregated without averaging; increased intensity, improved SNR.
Mode_2	2X vertical binning; values are aggregated and averaged, with limited or no increase in intensity	Not available
Mode_3	Region of interest only	2X horizontal and 2X vertical additive binning, in monochrome pixel formats only. CCD gain amplifier is disabled, resulting in reduced dark current. ROI is not available. Mode_3 uses a slower pixel clock and does not support overlapping exposure with readout of the previous image. Frame rates are compromised in this mode in favor of higher extended shutter times.
Mode_4	Not available	2X vertical binning and 2X horizontal subsampling; increased frame rate; available on color models only
Mode_8	Not available	Similar to Mode_3, except no binning is performed. Images can be outputted in all supported pixel formats.

1.5.3.2 Control and Status Registers (CSRs)

Description	Grasshopper	Grasshopper2
Redefined Registers		
LUT	1A40h – 1A44h Point Grey implementation	80000h – 80048h IIDC v1.32 implementation

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Description	Grasshopper	Grasshopper2
XMIT_FAILURE 12FCh	No presence bit	Presence bit
FRAME_INFO 12F8h	No inquiry bits for each embedded information type	Inquiry bits for each information type
New Registers		
Y16 Endianness	Controlled using IMAGE_DATA_FORMAT 1048h	DATA_DEPTH 630h IIDC v1.32 implementation
Mirror Image		MIRROR_IMAGE_CTRL 1054h
Y8 or Y16 Grayscale or Raw Bayer Output		BAYER_MONO_CTRL 1050h
Current Sensor Access	None	CURRENT 1A58h – 1A5Ch

1.5.3.3 Other Firmware Changes

Description	Grasshopper	Grasshopper2
IIDC Version	1.31	1.32
Color processing	Color models output greyscale information when run in standard (Format_0 or Format_1) Y8/Y16 modes. The conversion from raw Bayer information to greyscale is done on-board the camera.	On color models, conversion from raw Bayer information to greyscale is done on-board the camera.
Lookup Table	11-bit to 9-bit mapping Three (3) LUT's for RGB	9-bit to 9-bit mapping Two (2) banks, each containing three (3) channels for RGB
Trigger Modes	IIDC modes 0, 1, 3, 14, 15: Supported on all models IIDC modes 4, 5: Supported on 03S2 and 08S2 only	IIDC modes 0, 1, 3, 4, 5, 14, 15
Extended Shutter Times	> 10 s	Up to 330 s (Format_7 Mode_3 and Format_7 Mode_8)

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Description	Grasshopper	Grasshopper2
Memory Channels	Two (2) channels for user-defined configuration sets; one (1) channel for restoring to factory default settings	
Frame Buffer	32 MB for temporary image storage and re-transmission	
Non-Volatile Flash Memory	512 KB for data storage	
Pixel Clocks	Two (2) or more settings; may change with format/mode change	Max two (2) settings; will change only when setting to Format_7 Mode_3 or Format_7 Mode_8.

1.5.4 Software Support

Description	Grasshopper	Grasshopper2
FlyCapture 2.x Applications	Supported	Supported
FlyCapture 1.x Applications	Supported	FlyCap Demo GUI does not support new IIDC 1.32 video formats and other new features. New features are supported in the API.

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1.6 Additional Downloads and Support

Point Grey Research Inc. endeavors to provide the highest level of technical support possible to our customers. Most support resources can be accessed through the Support section of our website.

Creating a Customer Login Account

The first step in accessing our technical support resources is to obtain a Customer Login Account. This requires a valid name and email address. To apply for a Customer Login Account go to the Downloads page.

Knowledge Base

Our Knowledge Base contains answers to some of the most common support questions. It is constantly updated, expanded, and refined to ensure that our customers have access to the latest information.

Product Downloads

Customers with a Customer Login Account can access the latest software and firmware for their cameras from our Downloads page. We encourage our customers to keep their software and firmware up-to-date by downloading and installing the latest versions.

Contacting Technical Support

Before contacting Technical Support, have you:

1. *Read the product documentation and user manual?*
2. *Searched the Knowledge Base?*
3. *Downloaded and installed the latest version of software and/or firmware?*

If you have done all the above and still can't find an answer to your question, contact our Technical Support team.

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